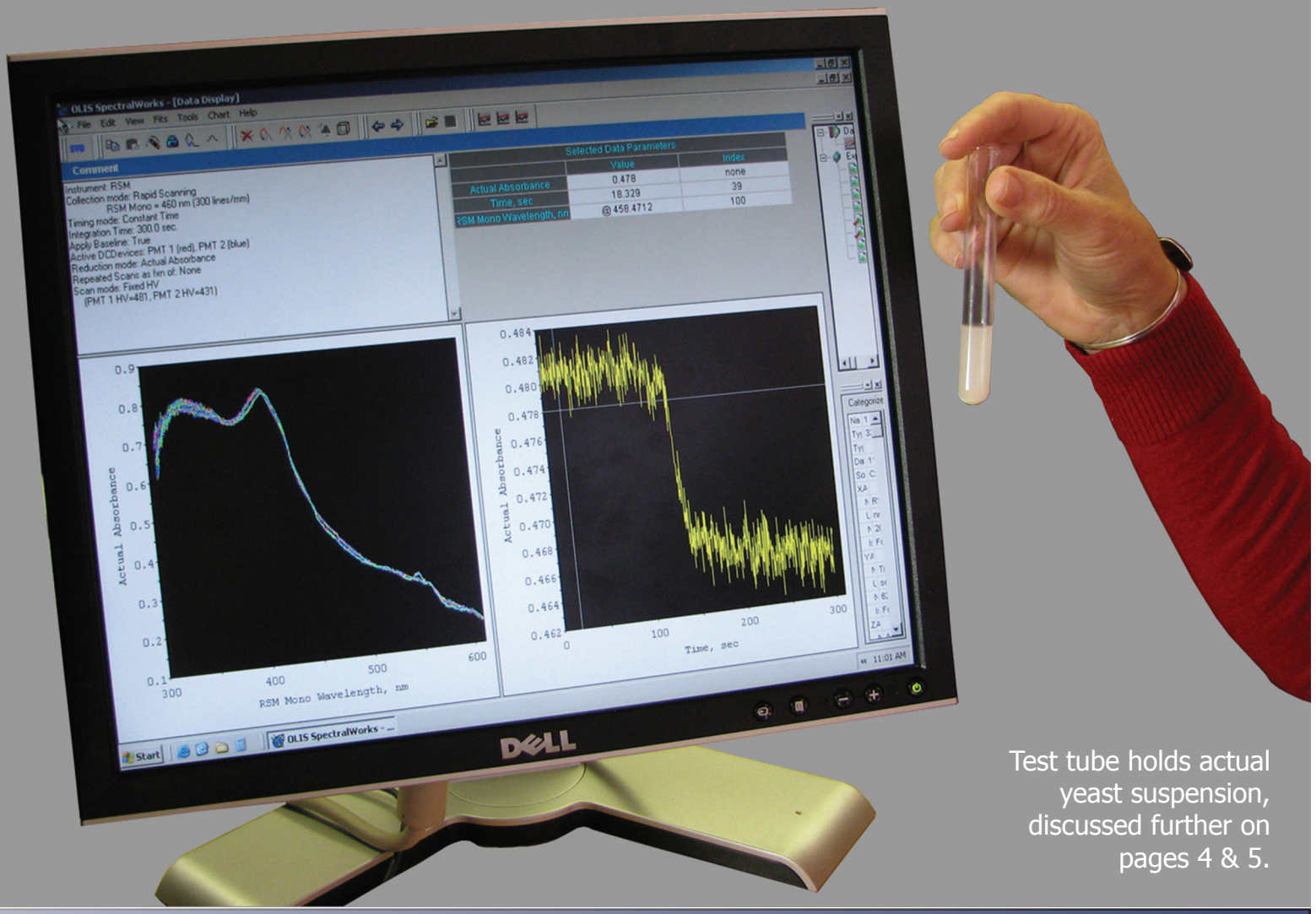
Olis CLARiTY

SPECTROPHOTOMETER SERIES

Scatter Does Not Matter! Only Sample Absorbance Does.

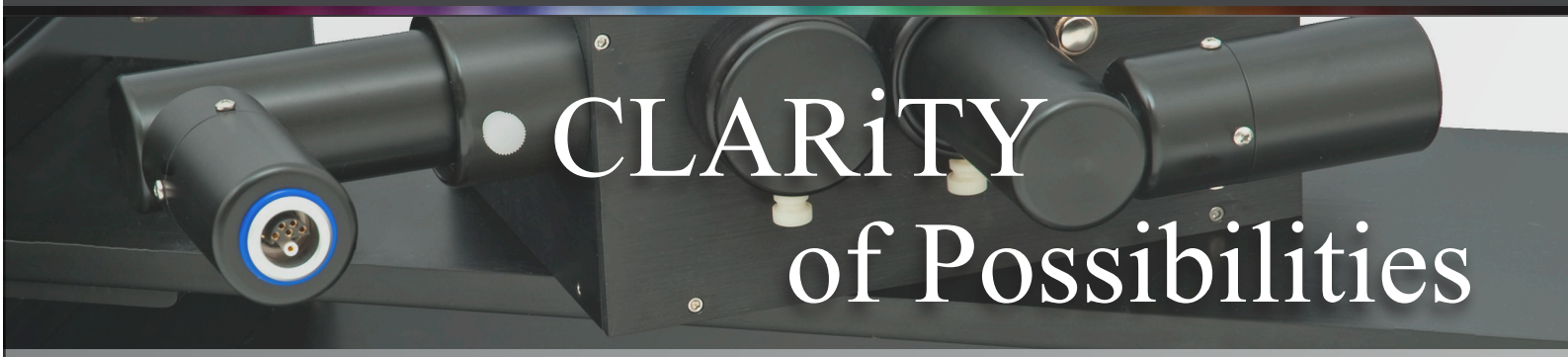


Test tube holds actual yeast suspension, discussed further on pages 4 & 5.

From the company that remains the only manufacturer of a millisecond scanning spectrophotomer comes a new product line for absorbance and fluorescence studies of living, whole cells: Olis CLARiTY

Rethink your possibilities

Olis



CLARiTY of Possibilities

The Olis CLARiTY spectrophotometer series ushers in the new and exciting era of spectral acquisition from "impossibly" turbid suspensions.

"This system is an almost incredible advance on the best Britton Chance was ever able to do for turbid suspensions."
Prof Em Quentin H. Gibson, July 2010

"You have gone full circle, from the reversion spectroscope at the start of the 20th century to the detector that we all want in the 21st century. That is truly cool."
Prof John S. Olson, July 2010

How will the CLARiTY help you take your research to the next level?

Imagine getting exactly the right absorbance reading on suspensions as widely disparate in turbidity as the five samples shown. The polystyrene particles used to create these suspensions have zero absorbance. Would your spectrophotometer return 0.0 AU as the answer for all five?

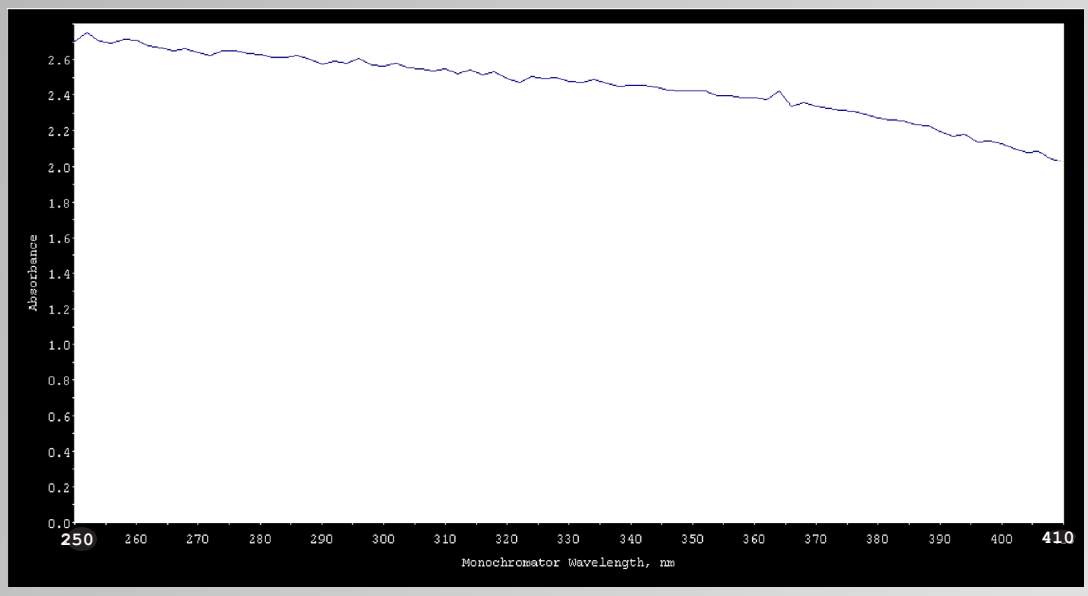
No. For decades, reliable, accurate absorbance studies have been dependent upon the homogeneity and clarity of the sample. Turbid samples produce apparent high absorbances, not the correct answer. Now, scatter does not matter.

The CLARiTY allows you to rethink your possibilities.

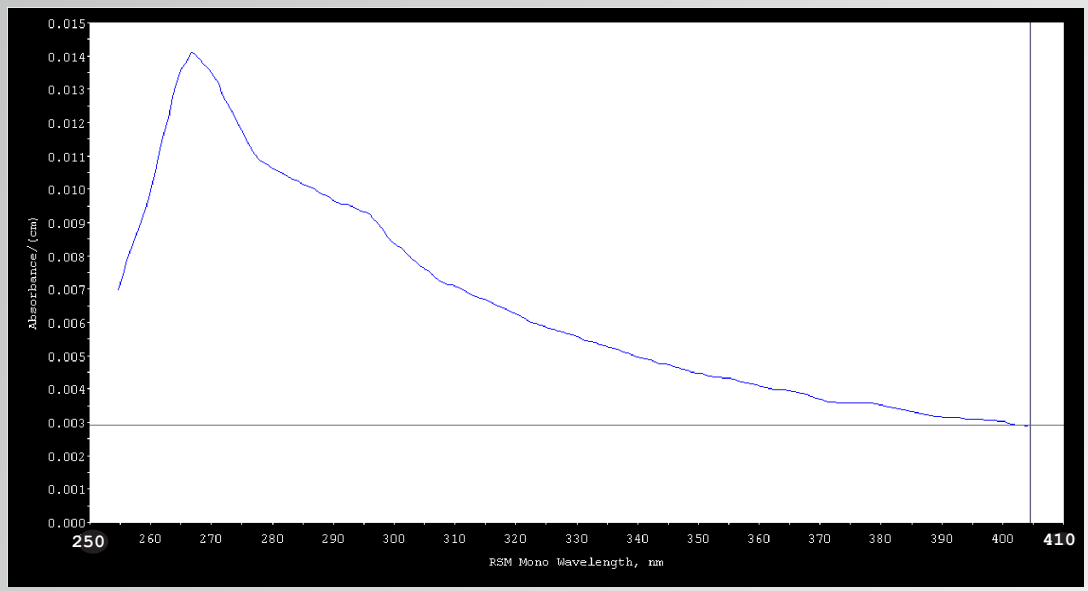
What is possible when scatter does not matter:

The following spectra were collected on an Olis computerized HP 8452 diode array and an Olis CLARiTY 1000A. The sample was provided by Dr. David Lynn's lab at Emory University, Spring 2011.

Protein spectrum as acquired by the HP 8452 diode array. The milky protein suspension is recorded as very high absorbance with no useful structural shape. Acquisition time was 3.5 seconds. **Y axis = 0 to 2.8 AU**

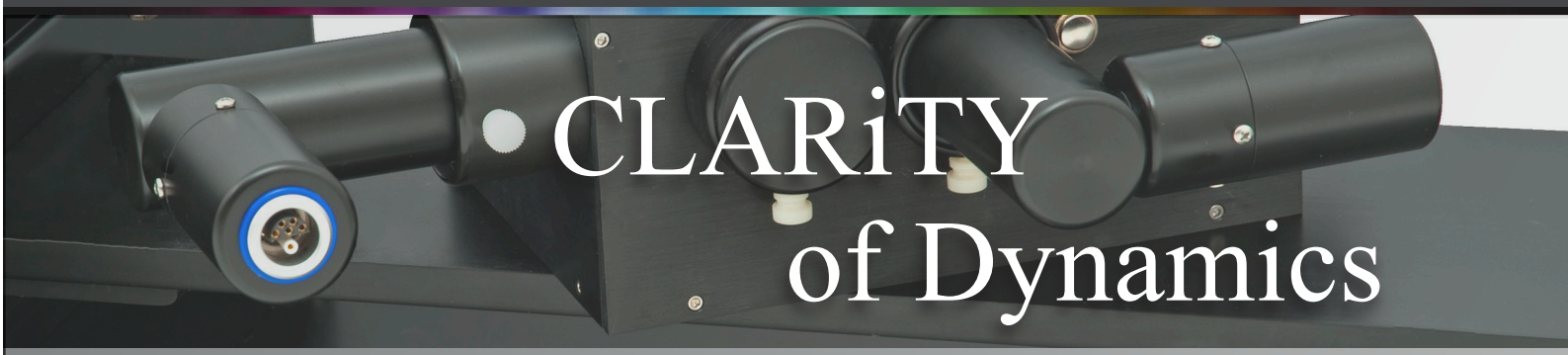


The same protein suspension at the same concentration was then scanned by the Olis CLARiTY 1000 spectrophotometer. Because scatter does not matter to the CLARiTY, the correct absorbance and a very descript (and accurate) spectral shape can be acquired. Data acquisition time was 5 seconds. **Y axis = 0.002 to 0.015 AU**



"Wow! I was not expecting to see a UV maximum at 265 and 295nm!! Maybe from exciton coupling between the phenylalanine aromatic electronic transitions. Definitely not something we could see with our UV." **-Anil Mehta, research associate with David Lynn**

Olis



CLARiTY of Dynamics

Study living, whole cells

The Olis CLARiTY allows you to study mitochondria, algae, bacteria, and other whole cells accurately and kinectically as they change within their **native environment.**

These spectra were captured with a CLARiTY 1000A. The sample is a 5 mg/mL suspension of living, intact S. cerevisiae cells in water.*

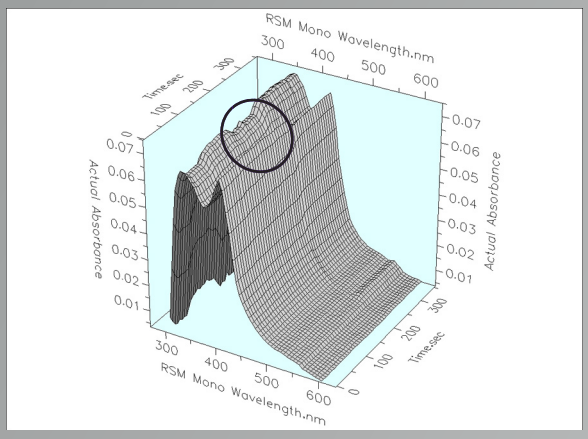
The electron transport chain-- captured here from the UV into the visible-- can be monitored using subsecond scan rates of the cells in their native, whole form.

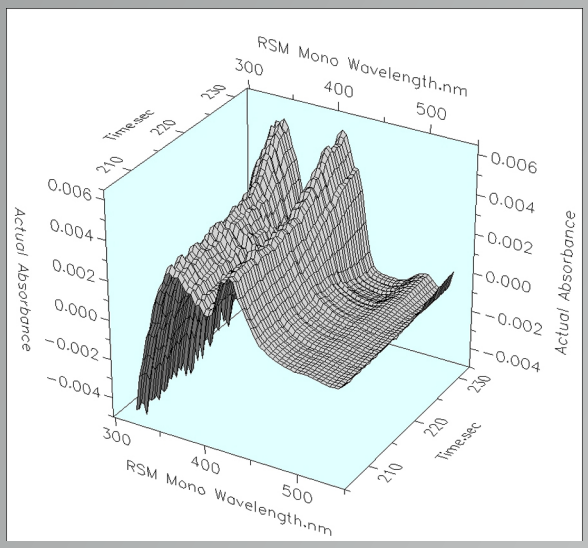
High fidelity spectra at subsecond speeds are exclusive to the Olis CLARiTY 1000, built around the patented Olis RSM* 1000 dual beam, double grating UV/Vis.

These spectra are displayed as 2 scans/second, averaged down from an actual acquisition rate of 100 scans/second.

Further details about the RSM 1000 start on page 9.

The second graph isolates the 20 second time frame of transition in the approximate midpoint of the full 5 minute study.





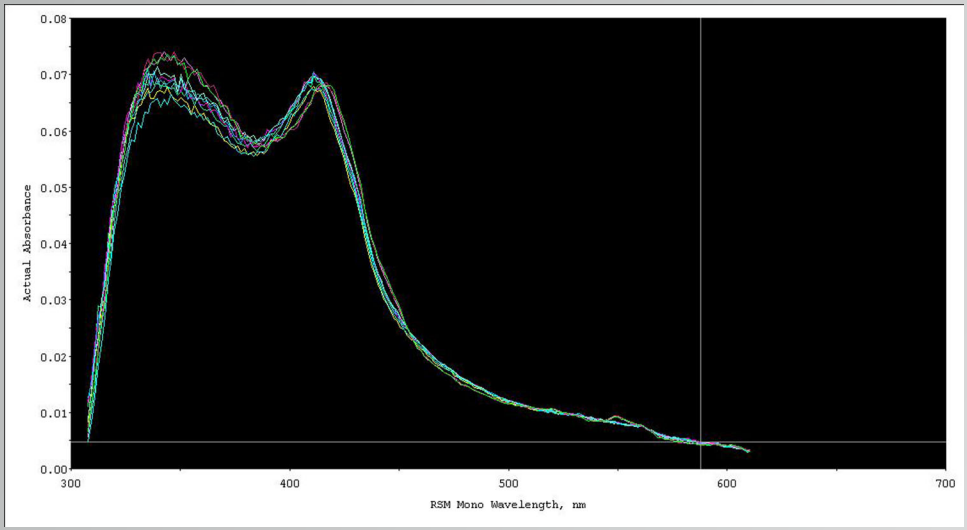
Facing Page

The reduced minus oxidized spectra, analogous to the DW-2 results, are calculated and shown on the facing page.

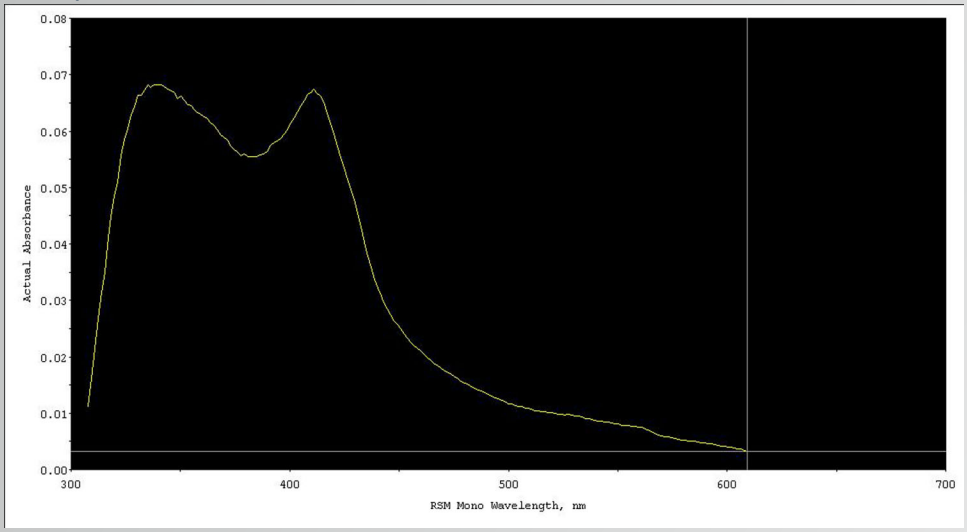
The kinetics at any particular wavelength can be extracted, allowing direct comparison of the spectra obtainable with the CLARiTY 1000A and fixed wavelength results from the last 50 years.

*These data are shown in 2D on the front cover
**Rapid-Scanning Monochromator

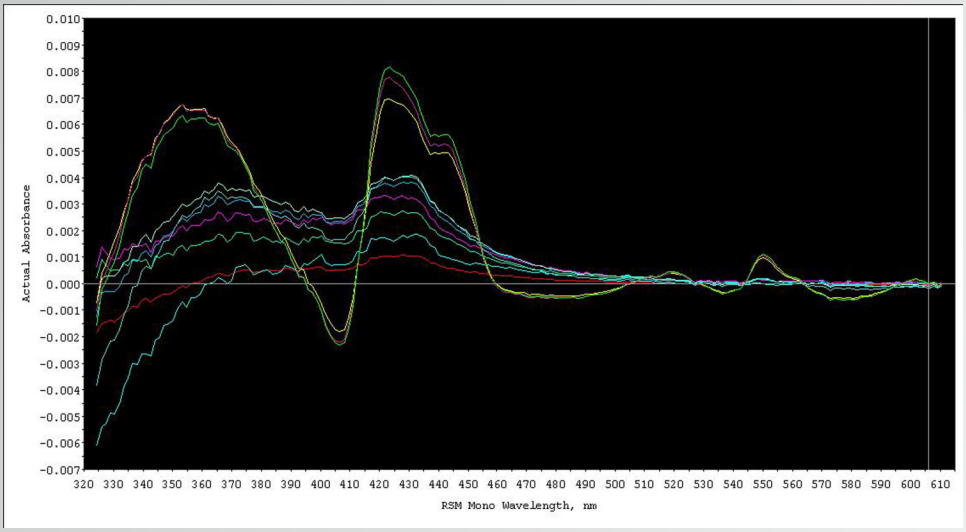
Nine spectra from within the 20 second transition period



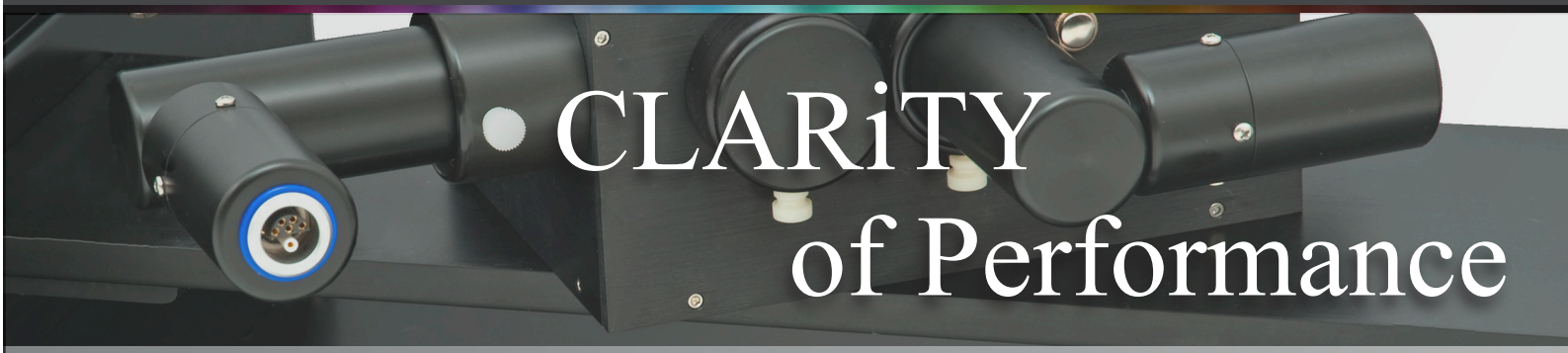
First spectrum which will be used as the subtrahend



Difference spectra capturing the classic reduced-oxidized spectra, plus another 60 nm into the UV, showing the NADP peak



Olis



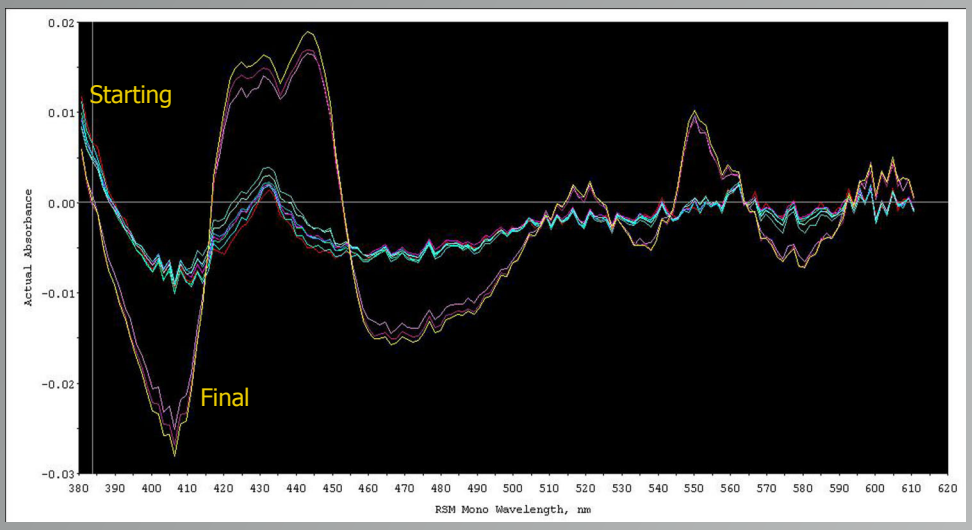
CLARiTY of Performance

Use all wavelengths of interest

The CLARiTY eliminates the effect of scatter at all wavelengths, **including the UV!**

These spectra represent the starting and ending forms of yeast cells before and after all available oxygen was consumed.

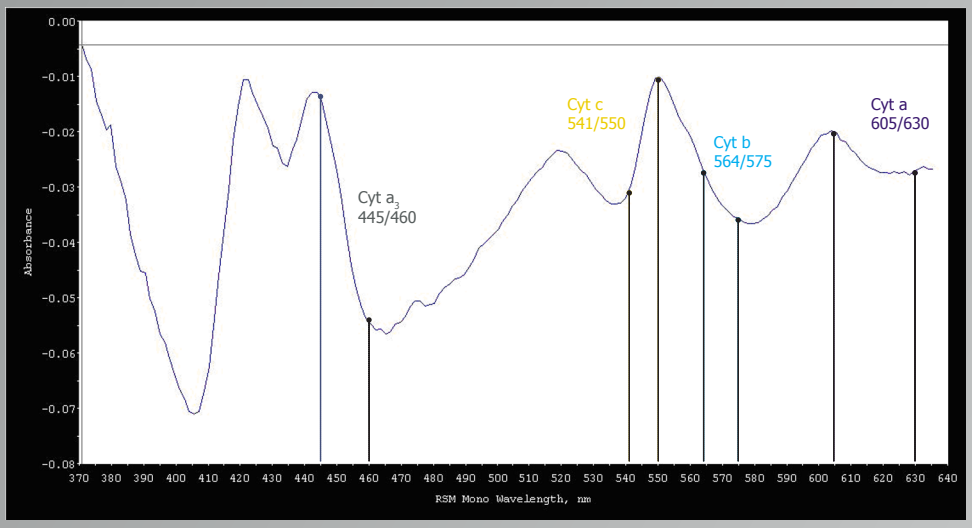
All data were acquired using a single measurement--one experiment lasting 390 seconds.



The answer is textbook correct!

Dual Wavelength pairs commonly used to identify cytochromes in the electron transport chain, as described in Weiner, M.W., Lardy, H.A.J., Biol. Chem., 248(22), 7682 (1973).

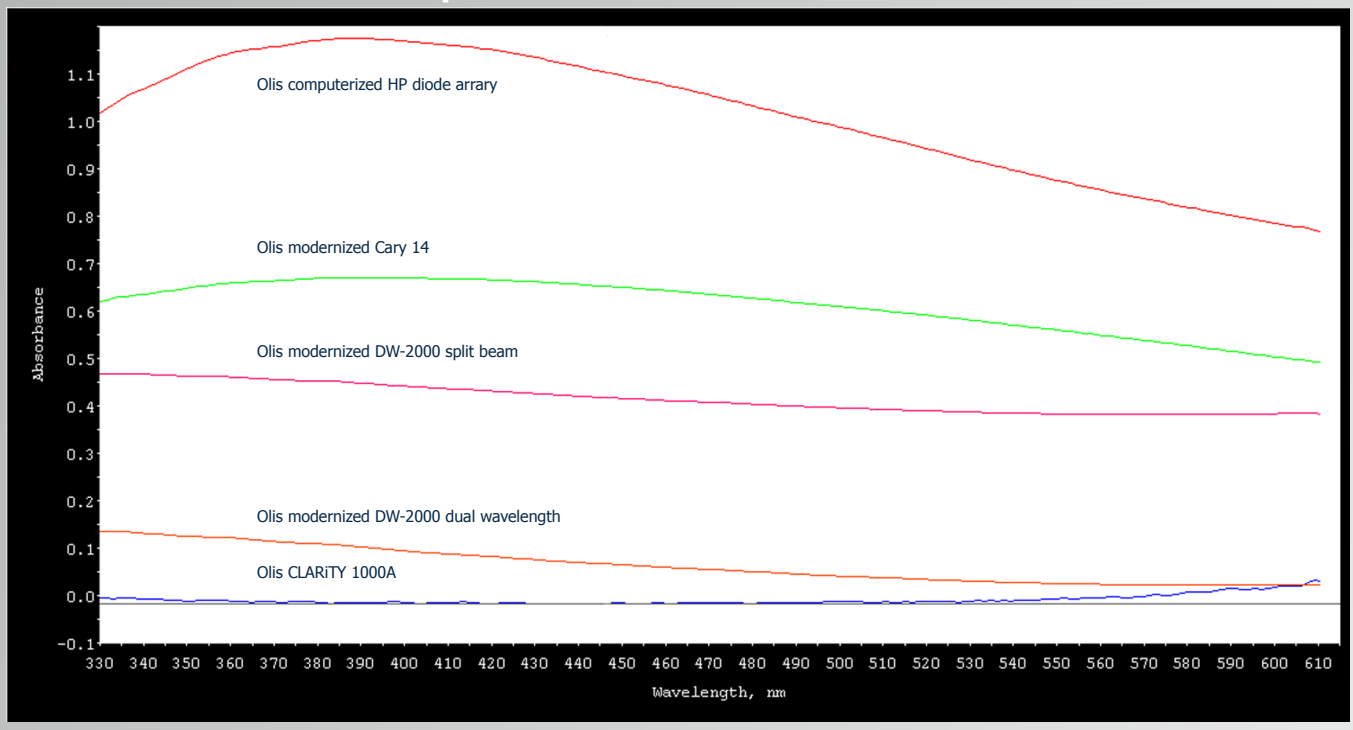
Any imperfections in wavelength correlation are attributed to difference in samples: rat liver cells vs. yeast cells.



Setting the new benchmark of performance.

For decades, spectrophotometrically working with turbid suspensions has proved elusive, because the measurement beam is scattered in all directions; only a fraction of it passes through the sample to the detector. "Apparent high absorbance" is the result, as these examples show.

Results from four popular and respected spectrophotometers compared with the Olis CLARiTY 1000



The sample was the most concentrated suspension of polystyrene particles in water (about 10^8 of the 1 micron particles/mL H_2O) as shown on page 2. Recall, polystyrene particles do not absorb light, so the correct answer is 0.0 AU.

The ubiquitous HP/ Agilent diode array spectrometer returns an answer that is more than 1.1 AU. The world-class dual beam, double monochromator based Cary 14 collected a maximum absorbance near 0.7 AU. As expected, better results were obtained from the "dual wavelength" spectrophotometer which was developed by Britton Chance expressly for the purpose of studying turbid samples.

In its split beam mode, the DW-2 reports absorbance of 0.5 AU and in its dual wavelength mode, an impressive <0.2 AU. Understandably, this dual wavelength model has held the honor as the "gold standard" of performance on turbid suspensions since the 1960s.

The CLARiTY, however, gets zero absorbance, give or take 0.01 AU.

And, as these and other data will show, scatter does not matter to the CLARiTY, including the UV, where even the "gold standard" cannot handle the scatter correctly.

CLARiTY of Design

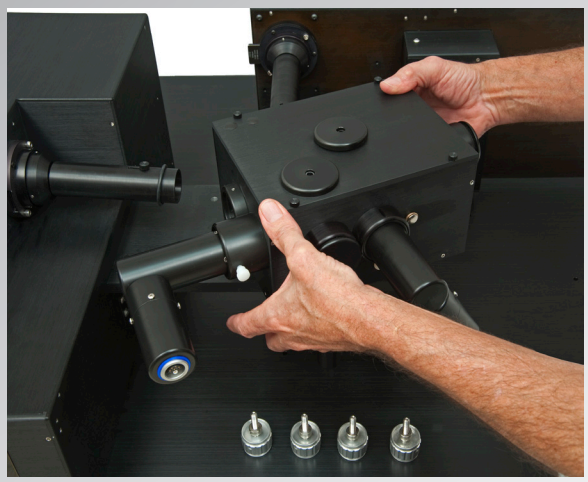
Ground-breaking, effective technology

The CLARiTY's sample compartment is the key to its total immunity to the effects of scatter.

In a normal spectrophotomer, when the focused beam of light passes through a turbid solution, most of the light is scattered in all directions, and only a tiny fraction of the original beam makes it into the detector.

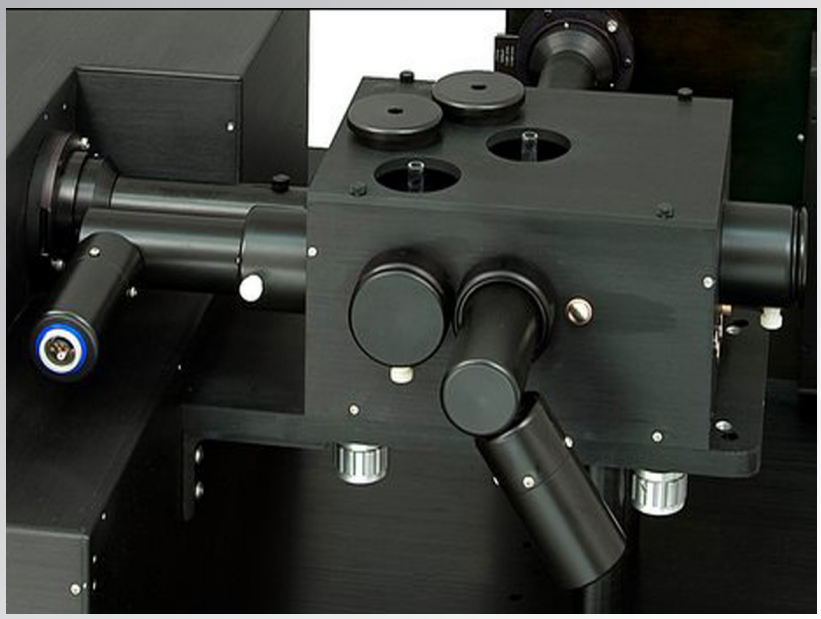
In the CLARiTY, the beam of light is a "gas of photons." The beam is not focused, but is instead fully diffuse. Because it is already fully diffuse, it cannot be scattered further by a light scattering sample.

We call the light diffusing sample holder a "DeSa Suspension Presentation Cavity" or DSPC. Early DSPC designs are spherical with long chimneys, allowing entry of reactants manually or with a titrator or other device.



The CLARiTY chamber houses the ground-breaking DeSa Suspension Presentation Cavity

Amazing pathlength enhancement



Because of an inherent pathlength enhancement caused by the DSPC, the CLARiTY's sensitivity is "amazing." Some labs will even choose this spectrophotometer for its sensitivity whether their samples are clear or turbid, because it allows use of exceedingly dilute concentrations. When working with human red blood cells, for instance, the dilution is 4000:1.

The DSPC does not need to be full. The correct answer is returned when the cavity is even partially filled. (The "absolute absorbance" does require that the volume of the cavity and the volume of sample be equal.) The gas of photons is everywhere within the DSPC, so we can say that "all of the light is seeing all of the sample all of the time." Photons are bouncing continuously within every position of the DSPC until fully absorbed or exiting and being

The ideal optical bench: an Olis RSM 1000

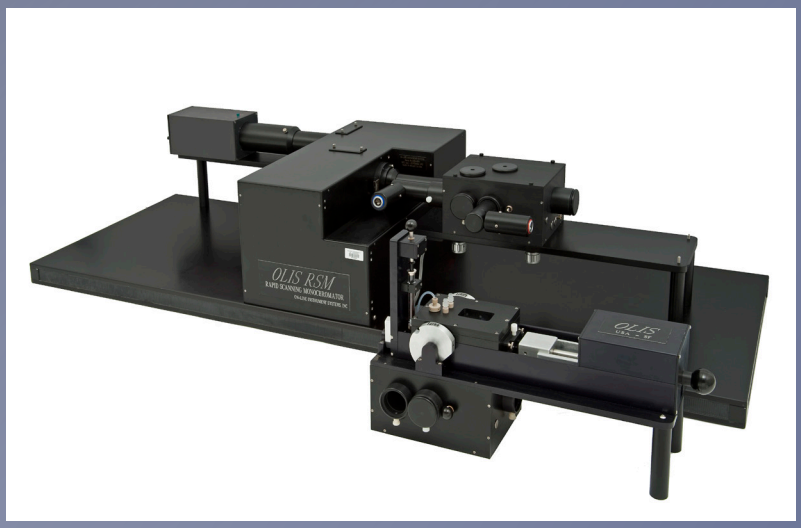
We offer three high performance spectrophotometers as hosts for the CLARiTY enhancement, but only the Olis RSM 1000 has all of the desirable optical characteristics – dual beam detection, monochromatic measurement beam, photomultiplier tube detection – **plus rapid wavelength scanning.**

First commercialized in 1992, the Olis RSM 1000 spectrophotometer is built around the patented DeSa Subtractive Double Grating Monochromator with Moving Intermediate Slit. (US Patent 5.285,254).

The Olis RSM 1000 can operate at true millisecond scan rates, supporting collection of 1000 scans per second. This is perfect for kinetic studies such as stopped-flow.

When used for CLARiTY studies, the RSM's scan rate is slowed by one or two orders of magnitude. The data shown in this brochure were collected at rates of 2 scans/ second.

This one workstation could be used to support your analysis of suspensions too



turbid for any other absorbance spectrophotometer to handle, and – with a tool-free exchange of the CLARiTY chamber for a different sample compartment – your high speed studies such as stopped-flow experiments on purified samples. Other sample compartment exchanges include one for circular dichroism.

The Olis RSM 1000 + the CLARiTY chamber = the Olis CLARiTY 1000.

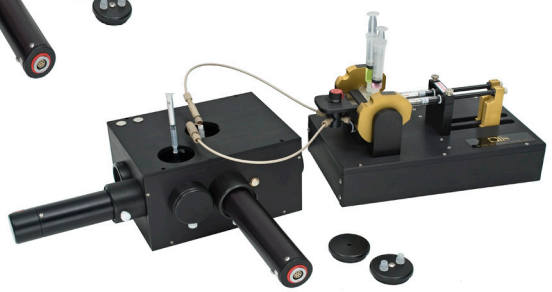
Utterly unique and incredibly useful, supporting full spectral recordings of metabolic processes in living, intact cells …much more.

detected by the photomultiplier tube, so even just a puddle of suspension at the bottom of the cavity is sufficient.

This repeated bouncing of the photons within the measurement beam is due to the highly reflective (inert) materials surrounding and encasing the quartz cavity. As the light bounces off of the walls of the cavity over and over again, the effective pathlength is enhanced to be many centimeters. In the 4 mL DSPC, the effective pathlength is 20 centimeters! Clearly, very little sample is necessary for accurate and sensitive results.

Not filling the DSPC with the experimental sample allows room for the addition of reactants. We have an automatic titrator, which is perfect for this purpose, shown at right.

Add reactants manually to the DSPC with syringes



DSPC with Olis Automatic Titrator

CLARiTY of Choice

You have options.

The CLARiTY enhancement can be made to at least three Olis spectrophotometers, providing you with three options for data acquisition rates, spectral ranges, and price points.

CLARiTY 1000

The CLARiTY 1000 combines the innovative CLARiTY performance with the unbeatable speed and sensitivity of the Olis RSM 1000 rapid-scanning spectrophotometer. Choose this model when you want

- Highest speed (≤ 100 scans/ second) spectral scanning
- Utility in alternative measurements such as stopped-flow and CD (≤ 1000 scans/second)
- Spectral ranges of 170-540 nm, 200-800 nm, 400-1100 nm, or 800-1700 nm, including the option of all three ranges with trivial hardware exchanges

Scatter does not matter, also available on non-rapid-scanning models

CLARiTY 620

The CLARiTY 620 is a tiny, non-rapid-scanning version of the 1000. Choose this model when

- Your sample is static or very slow to change
- Utility in alternative measurements such as CD
- Spectral range of 170-700 nm, 400-1100 nm, or 800-1700 nm

CLARiTY 17

The CLARiTY 17 employs the world-class Cary 14/17 prism + grating monochromator. The DSPCs replace the old style cuvette holders. Choose this model when

- Your sample is static or very slow to change
- Utility in alternative measurements such as CD
- Sub-nanometer spectral resolution, to 0.1 nm
- Spectral range within 185-2600 nm

Which CLARiTY model is right for you?

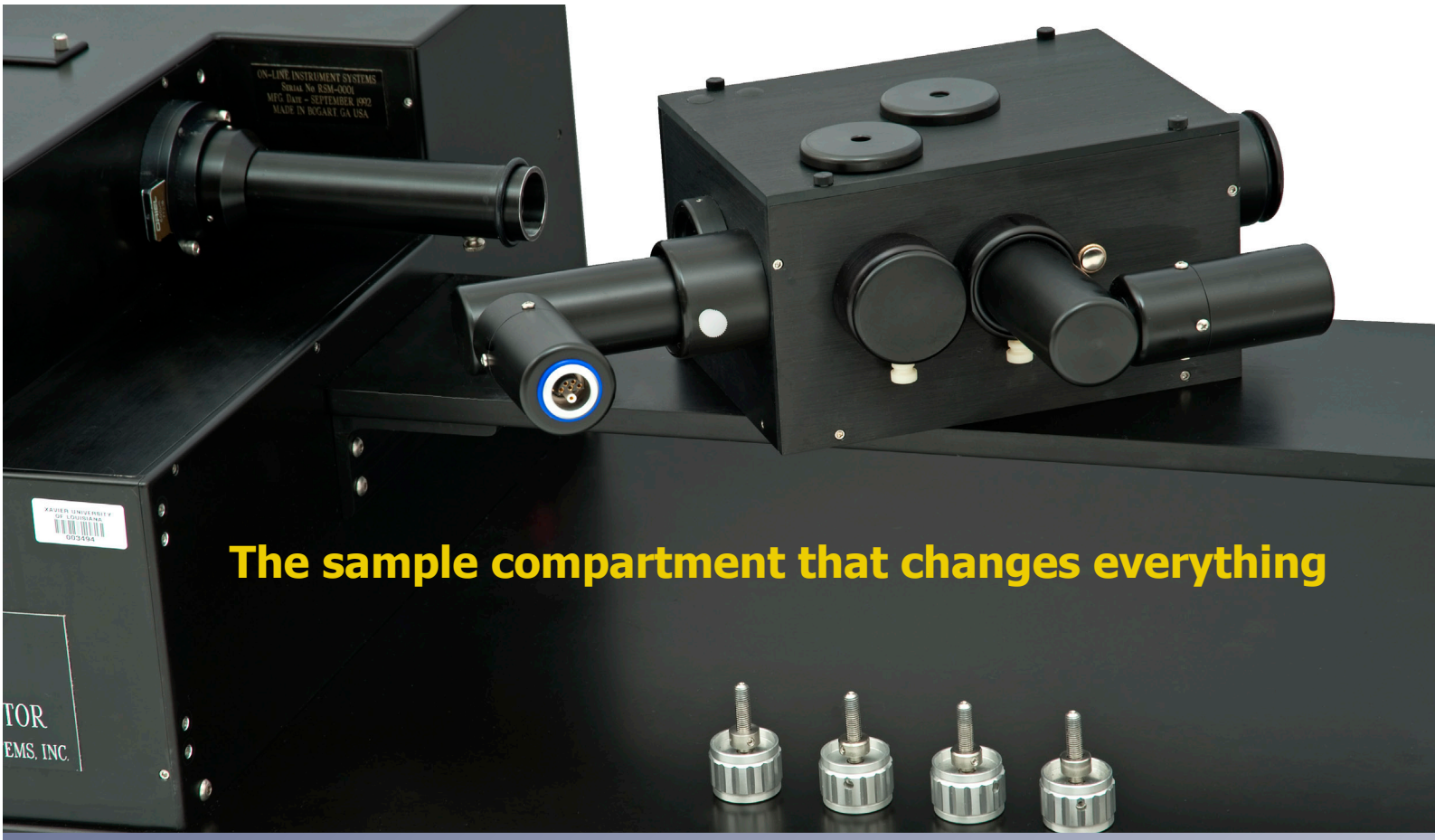
	CLARiTY 1000	CLARiTY 620	CLARiTY 17
Rapid-scanning	✓	na	na
Scatter Immunity	✓	✓	✓
Pathlength enhancement	✓	✓	✓
Dual beam detection	✓	✓	✓
Monochromatic measuring beam	✓	✓	✓
Photomultiplier tubes	✓	✓	✓
UV/Vis	✓	✓	✓
NIR	available	na	✓

Your choice of DSPCs

The CLARiTY chamber can be fitted with a growing collection of DSPCs. The choice of quartz cavities within each DSPC is limited only by what a master glassblower can produce.

The default choice is a 4 mL spherical cavity. Larger and smaller spherical cavities are available. Shapes to suit NMR tubes or thin films are (or will soon be) available. Thin films, hydrogels, powders, and other non-aqueous suspensions as well as aqueous can be studied with the right DSPCs.

Exchanging one DSPC for another is a 2-4 minute process, so a single CLARiTY can be fitted with just the right cavity for a wide range of sample types.



An extraordinary advance over prior technology alternatives:

- Total immunity to the effect of scatter
- Enormous pathlength enhancement
- Astonishing sensitivity
- Stirring and thermal control standard
- Supports your choice of solvent volumes and/or solid shapes and sizes
- Added easily and quickly to many Olis spectrophotometers and fluorimeters (four large thumbscrews hold a given sample compartment on the railing)
- Accurate absorbance on clear and turbid samples

For more details about the Olis CLARiTY series and other Olis products:

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